FLEXIBLE KEEL AND FITTING THEREFOR

The present invention relates to a water craft having a keel. In particular, but not exclusively, the invention relates to an amphibious vehicle having a keel.

A keel is provided on the underside of a water craft, for example a boat, surfboard, sailboard or the like, one purpose of which being to assist in the stability and control of the craft in use, in particular against lateral wind and water forces.

In the case of a small water craft which is intended to be portable and to be stored on land, for example a surfboard or sailboard, a keel can make the craft less portable, and difficult to store.

An amphibious vehicle is required to emulate a boat as closely as possible on water, as well as operating as a road vehicle on land. A keel is often provided on the hull of an amphibious vehicle to aid handling and manoeuvrability of the vehicle on water. However, in the transition from water to land, or simply as the vehicle manoeuvres on land, there is a risk that the keel may strike or drag on the surface along which the vehicle is moving and thus become damaged.

It is an object of the invention to provide a water craft having a keel in which the above mentioned disadvantages are reduced or substantially obviated.

It is a further object of the invention to provide a water craft having a keel which is easily repairable or replaced in the event of it being damaged.

According to a first aspect of the present invention, there is provided a water craft having a keel mounted to the underside of the craft, characterised in that the keel comprises an elongate member having at least one mounting formation for cooperative engagement with at least one corresponding mounting formation on the underside of the water craft, for removably mounting the elongate member on the water craft.

The elongate member is preferably an extrusion.

The elongate member is preferably flexible.

Preferably, the elongate member is adapted for sliding engagement with the at least one corresponding mounting formation on the underside of the water craft.

Conveniently, the or each formation on the elongate member has a profile adapted for complementary engagement with the at least one corresponding mounting formation on the underside of the water craft.

In a preferred embodiment, the at least one corresponding mounting formation is provided in or on a mounting member mounted to the underside of the water craft.

Preferably, the mounting member is an extrusion. More preferably, the mounting member is made from extruded aluminium.

In a preferred embodiment, the water craft has a hull and the keel is removably mounted to the hull.

In a preferred embodiment, the underside of the hull is a moulding having a channel formation, and the at least one corresponding mounting formation is provided in or on a mounting member located in the channel.

Preferably, the water craft is an amphibious vehicle.

Preferably the elongate member is made from rubber or synthetic rubber.

Preferably, the keel further comprises a tip member located adjacent a forward end of the elongate member.

Preferably, the elongate member has an elongate, longitudinal cavity. In which case, the elongate member may be adapted to be inflated, using either water or gas, to vary its profile. Alternatively, the cavity may be filled with a foam material.

According to a second aspect of the invention, there is provided an amphibious vehicle having a hull and a keel mounted to the hull, characterised in that the keel comprises an elongate extruded member having at least one mounting formation for cooperation with a corresponding formation on an extruded mounting member attached to the hull, for removably securing the elongate member to the hull.

Preferably, the at least one corresponding formation is a re-entrant channel into which a formation on the elongate member is slidably received. The channel may be open at one end and the keel may further comprise a tip member attached to the hull adjacent the open end to prevent the elongate member from being withdrawn from the channel in use. In a particularly preferred embodiment, a metal cap member is provided over the tip member.

The invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic plan view from below of a water craft having a keel in accordance with the invention;

Figure 2 is a side view of the keel shown in Figure 1;

Figure 3 is a diagrammatic cross-sectional view taken on line A-A, through a part of the base of the hull of Figure 1;

Figure 4 is a diagrammatic cross-sectional view similar to that of Figure 3 but showing an alternative arrangement for mounting the keel to the hull; and

Figure 5 is a diagrammatic cross-sectional view similar to that of Figures 3 and 4, showing

a further alternative arrangement for mounting the keel to the hull.

A water craft in the form of an amphibious vehicle is indicated generally at 10 in Figure 1, having a body which incorporates a hull 12. A keel 14 is provided centrally on the base of the hull 12 in the longitudinal axis and extends along substantially the entire length of the base.

As can be seen best from Figure 2, the keel 14 comprises a main elongate member 16, which extends along the greater part of the length of the base of the hull 12. The elongate member 16 is formed as an extrusion of a relatively flexible material. Any suitable material can be used but in preferred embodiments the elongate member is made of rubber or synthetic rubber. The keel also has a tapered tip member 18 which is positioned adjacent to the forward end of the elongate member 16. The tip member 18 may be made of any suitable material but is also preferably made from rubber or synthetic rubber and is shaped to provide good hydrodynamic performance as the vehicle travels forwardly through the water. A metal cap 20 may be positioned over the tip member 18 to protect the tip member from damage. The metal cap 20 is shaped to complement the shape of the tip member.

The keel 14 assists in the handling and manoeuvrability of the vehicle 10 on water. The material and configuration of the elongate member 16 are selected so as to provide sufficient lateral stiffness in order to withstand the lateral water pressures, whilst being readily compressible vertically to resist damage through impact with the ground when the vehicle is being used on land or in the transition between land and water use.

Whilst the elongate member 16 is designed to resist being damaged, such damage may nevertheless occur. In order that repair and/or replacement of the elongate member can be effected, the elongate member 16 is adapted to be slidably removable from the hull 12, as will be described below. Removal of the elongate member 16 from the hull, may also be useful when servicing of the vehicle and/or repair of the hull are required. Preferably the tip member 18 and the metal cap 20 are also removably mounted to the hull so that the entire keel 14 can be removed for replacement and/or repair.

With the exception of the hull 12 and the keel 14, the amphibious vehicle 10 is of a known construction and will not be described in any further significant detail.

Part of the base of the hull 12 is shown in Figure 3, which includes a channel formation 22 extending in the longitudinal axis of the hull 12 and having a re-entrant profile. The elongate member 16 is formed as a hollow extrusion of substantially bell or V-shaped cross-section and has an upper (as viewed) mounting portion 24 which is slidably received in the channel formation 22. The upper mounting portion 24 of the elongate member 16 has an outer profile which is formed so as to correspond with the re-entrant profile of the channel formation 22, to enable the elongate member to be securely mounted to the hull 12 in a complementary sliding fit.

The hollow configuration of the elongate member 16 having a generally V-shaped cross-section provides the required lateral stiffness, but is readily compressible vertically. In a particularly preferred embodiment, the elongate member 16 is produced from a rubber material having a hardness of Shore 45-55. If required, the elongate member 16 can be adapted so as to be inflatable, using either water or gas, in order that the profile of the elongate member can be varied.

In an alternative embodiment (not shown) the cavity in the elongate member 16 is filled with a foam material. In this arrangement, the vertical and lateral stiffness of the elongate member 16 can be adjusted by appropriate selection of the foam material and the thickness and shape of the outer walls. A foam filled elongate member could be produced by means of a two-part extrusion process. Alternatively, the foam could be injected into the cavity of the elongate member 16 after it has been extruded.

The channel formation 22 is closed at the rear end of the vehicle and open at the forward end such that the elongate member 16 can be slid into and out of the channel formation 22 through the open, forward end. The tip member 18 is fixed to the hull adjacent to the open end of the channel formation 22 to prevent the elongate member from being withdrawn from the channel formation in use. The tip member 18 may be solid rather than hollow so that it

is less susceptible to impact damage than the elongate member 16. The metal cap 20 also helps to prevent the tip member 18 from being damaged and from being ripped off the hull in the case of an impact. The tip member 18 may be fixed to the hull using screws, bolts or like fasteners or may be bonded to the hull.

The elongate member 16 can be easily removed from the hull 12, as required, by removing the metal cap 20 and the tip member 18 and sliding the elongate member out of the channel formation 22. To replace or fit the elongate member 16, the above procedure is reversed.

It will be understood that whilst it is preferred that the channel 22 is open at the forward end this is not essential and the channel could be open at the rearward end or indeed at both ends. Furthermore, whilst in the preferred embodiment the open end of the channel is closed by the tapered tip member 18 any suitable means for preventing withdrawal of the elongate member 16 could be used.

In the manufacture of amphibious vehicles and other water craft, it is common practice to produce the hull 12 as a one-piece moulding from a suitable material such as glass fibre. However, producing a re-entrant channel formation, such as the formation 22 in Figure 3, directly in a moulded hull is difficult and time consuming. Figure 4 shows an alternative mounting arrangement which is designed to over come this problem.

Figure 4 shows modified hull 12 for an amphibious vehicle in accordance with a preferred embodiment of the invention. The underside of the hull 12 is formed as a one-piece fibre-reinforced moulding having an integrally formed substantially rectangular channel formation 28. Although the channel formation 28 is shown as having substantially vertical faces, it will be understood by those skilled in the art that a draft angle could be applied to the vertical faces to aid de-moulding. A mounting member 30 is securely bonded in place in the channel formation 28, although any suitable securing means can be used. The mounting member 30 consists of an elongate extrusion having a re-entrant channel formation 32 which corresponds in profile with the profile of the mounting formation 24 on the elongate member 16. The elongate member 16 is slidably secured in the channel 32 of the mounting member 30 in the

same way as it was secured in the channel formation 22 in the previous embodiment. The extruded mounting member 30 can be manufactured from any suitable material but is preferably made of extruded aluminium (including aluminium alloys) or some other material which is capable of withstanding prolonged immersion in sea water.

By providing the corresponding mounting formation 32 for the elongate member 16 in a mounting member 30 which is itself attached to the hull, the need to produce a re-entrant mounting channel formation in the hull is avoided, so reducing manufacturing time and cost for the hull. The outer profile of the mounting member can be selected such that the channel formation 28 in the hull is easy to mould. Furthermore, because both the elongate member 16 and the mounting member 30 are extrusions, the time and cost of manufacturing the keel can be kept to a minimum.

A further embodiment of a keel according to the invention is shown in Figure 5. In this embodiment, two elongate extruded mounting members 34, 36 are mounted in a rectangular cross-section, channel formation 38 in the underside of the hull 12. Each extrusion 34, 36 is of a substantially rectangular box-section, wherein the lower wall of the box-section, as viewed, includes an aperture 40 which extends along the length of the extrusion 34, 36 such that each mounting member provides a re-entrant channel formation 41. The elongate member 42 is of substantially V-shaped cross-section and the free end of each limb of the V-shape includes an enlarged formation 44, which is slidably received in the channel 41 of a respective extrusion 34, 36. The enlarged formations 44 are of a dimension greater than the width of the aperture 40 in each extrusion 34, 36, to slidably secure the elongate member 42 to the mounting members 34, 36 on the hull 12.

Whereas the invention has been described in relation to what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention is not limited to the disclosed arrangements but rather is intended to cover various modifications and equivalent constructions included within the spirit and scope of the invention as claimed. For example, whilst the invention has been described above principally in relation to an amphibious vehicle, it will be understood that the invention can be applied to any form of

water craft, for example a boat, surfboard, sailboard or the like. Furthermore, whilst in the preferred embodiments, the corresponding mounting formation on the underside of the water craft takes the form of a re-entrant channel, this need not be the case and any suitable formation(s) can be used to enable the elongate member to be removably mounted to the hull. For example, rather than the corresponding mounting formation being in the form of a continuous channel, it could take the form of a number of channel portions spaced apart along the length of the underside of the water craft. Moreover, whilst it is preferred that the elongate member be a slide fit with the corresponding mounting formations this also is not essential and the elongate member can be arranged, for example, to be a snap fit with the corresponding mounting formations on the underside of the water craft. Alternatively, it could be arranged that the elongate member is mounted by inserting one side at a time into the corresponding mounting formations rather than being slid in longitudinally. It should also be understood that whilst in the preferred embodiments only one keel is shown on the hull of the vehicle, more than one keel can be used on a water craft in accordance with the invention. For example two keels can be fixed along the hull, one on either side of the longitudinal centre line of the hull.